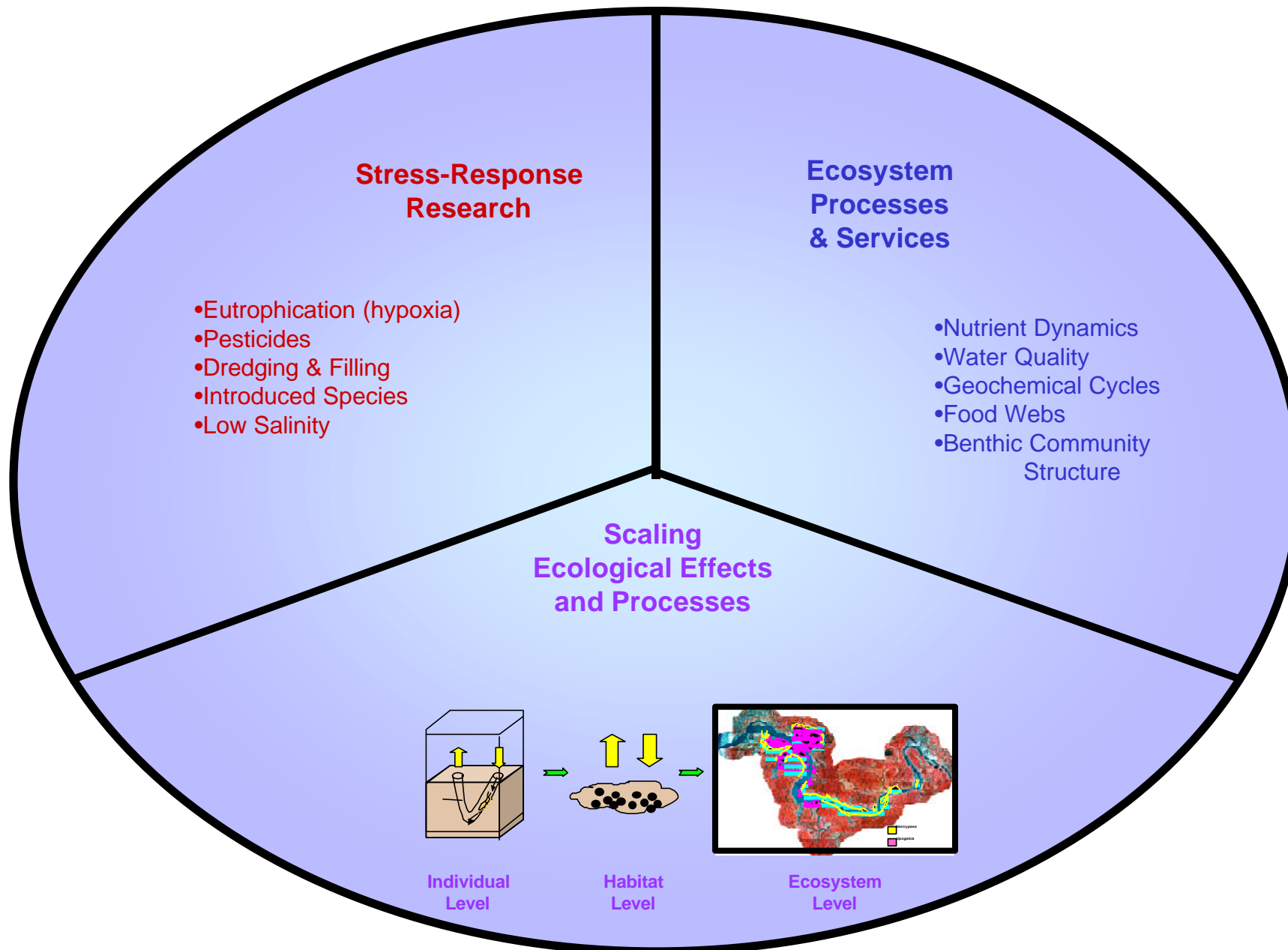


Effects of Stressors on Burrowing Shrimp Populations in Pacific NW Estuaries and Consequences for Ecosystem Processes and Services

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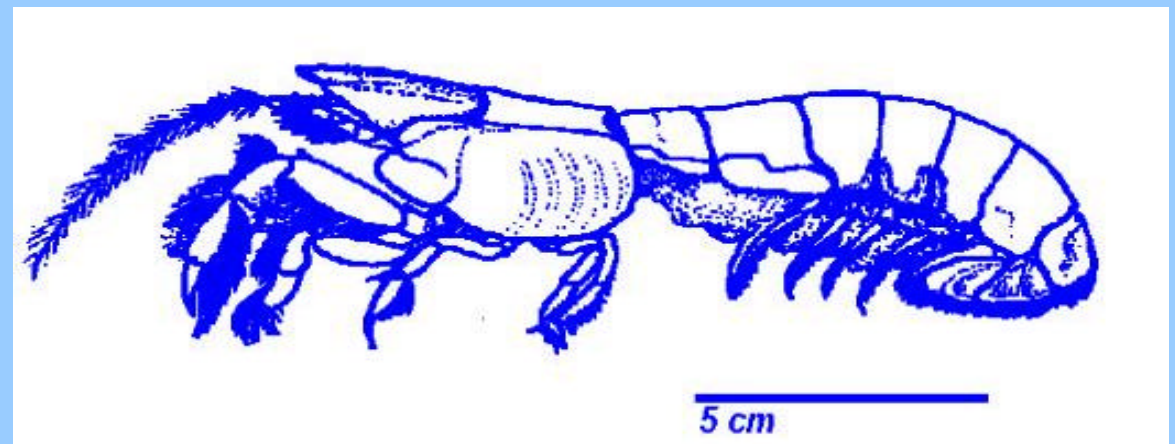
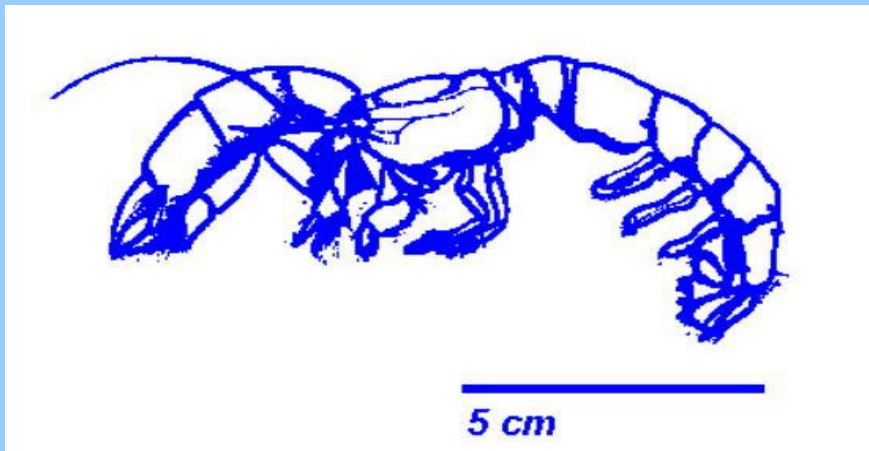
BURROWING SHRIMP POPULATIONS IN PACIFIC NORTHWEST ESTUARIES



*Neotrypaea
californiensis*



*Upogebia
pugettensis*



Stress-Response Research

- Eutrophication (hypoxia)
- Pesticides
- Dredging & Filling
- Introduced Species
- Low Salinity

Stressors: Pesticides

(Oyster Aquaculture)

Carbaryl Pesticide Control of Burrowing Shrimp on Willapa Bay Oyster Farms



Stressors: Eutrophication & Non-Indigenous Spp.



Eutrophication Effects

- Smothering by Algae
- Hypoxia & H₂S

Effects of NIS *Spartina* & *Z. japonica*

- Competition for Space
- Sedimentation

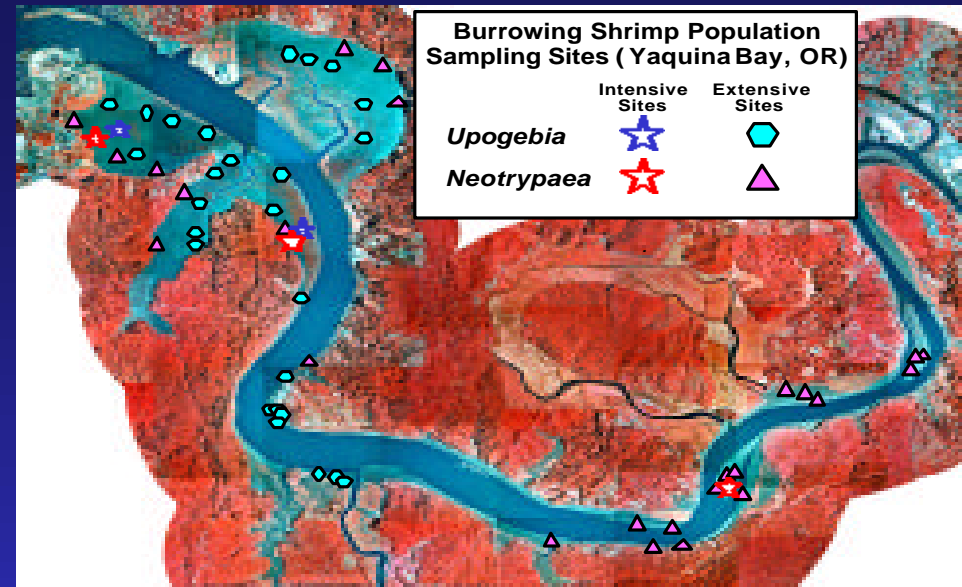


Stress-Response Lab & Field Studies

Population-Level Responses to Stressors

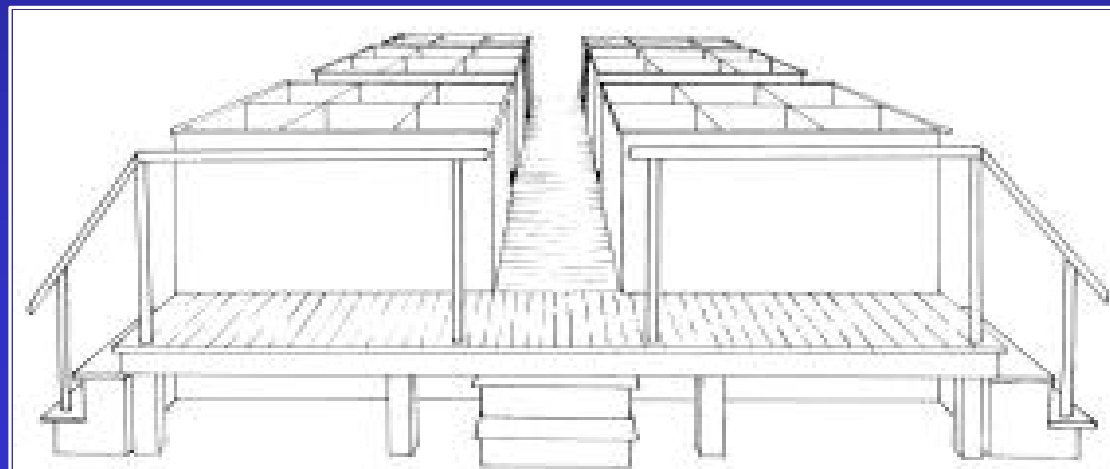
Field Studies

Variation in Population
Structure Along
Stressor Gradients

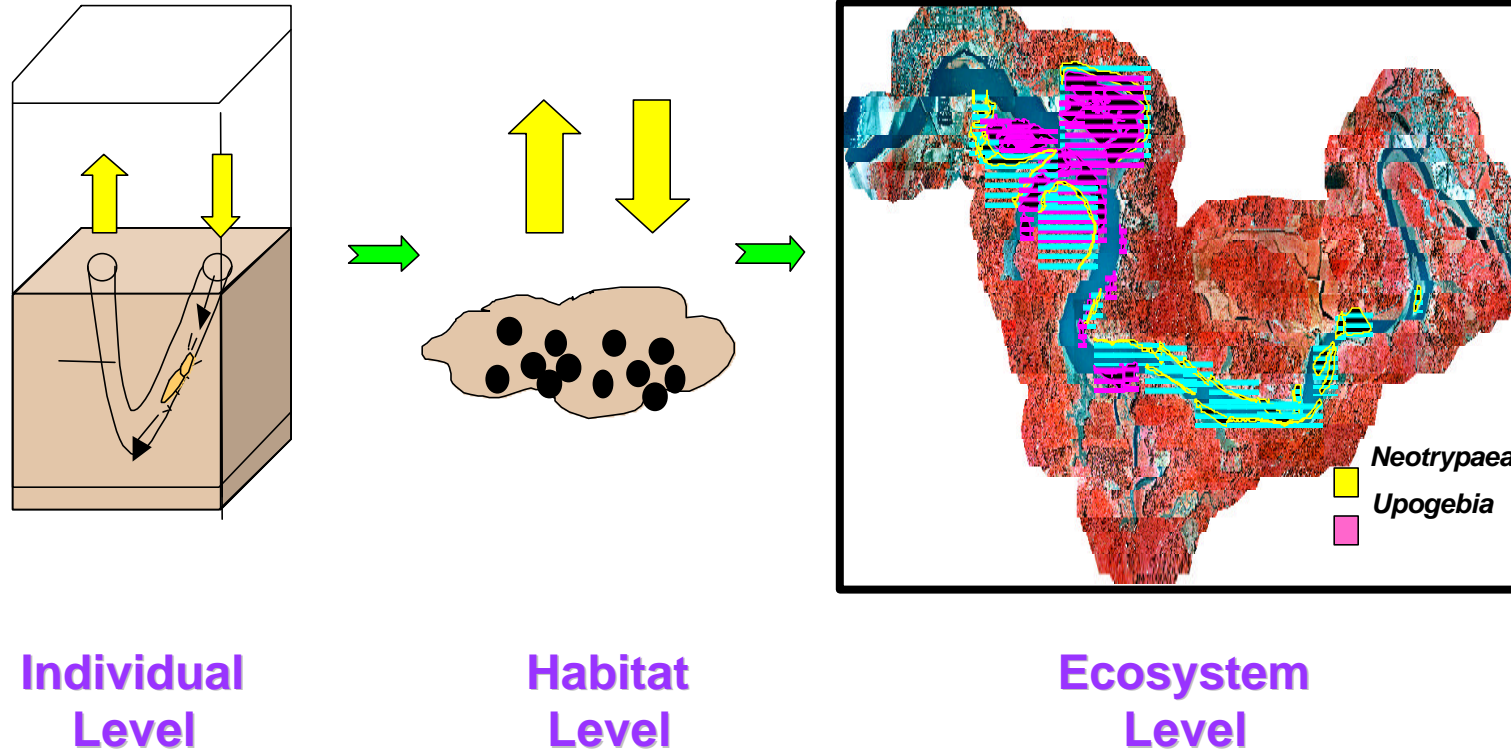


Mesocosm Studies

Effects of Stressors
on Physiology,
Growth, Survival

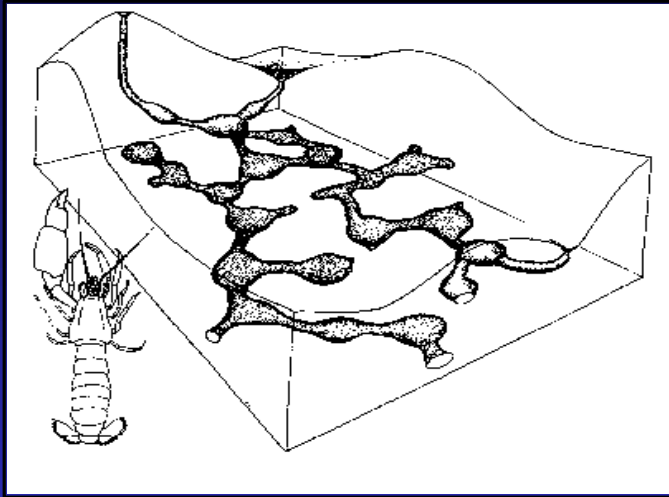


Scaling Ecological Effects and Processes



Ecological Attributes of PNW Burrowing Shrimp

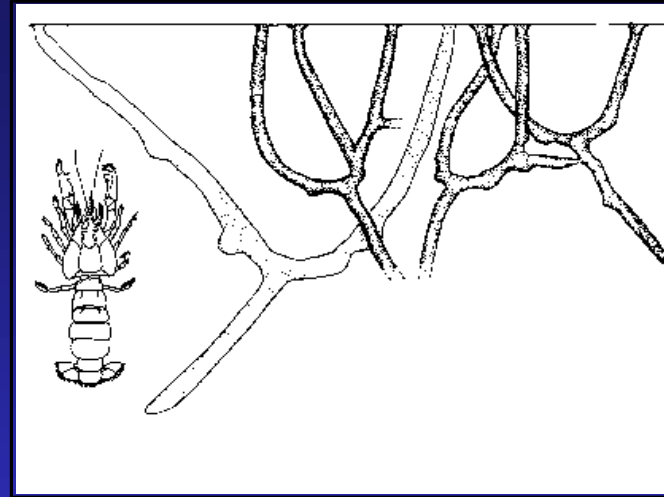
Dominant Burrowing Shrimps of PNW Estuaries



Neotrypaea californiensis

Upper Intertidal
Continuous Burrower
500+ burrows/m²
Burrows 0.5+ m deep
Deposit Feeder

BIOTURBATOR



Upogebia pugettensis

Mid-Intertidal to Subtidal
Semi-Permanent Burrows
300+ burrows/m²
Burrows to 1+ m deep
Suspension Feeder

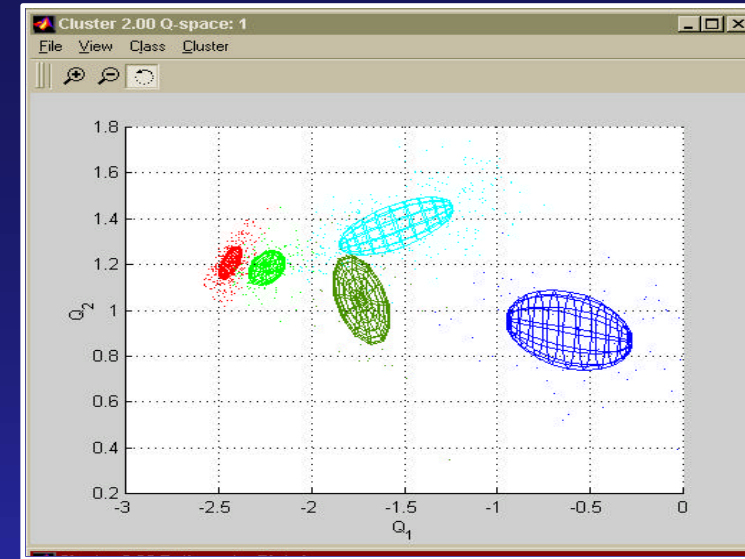
BIOIRRIGATOR

Remote Sensing Methods

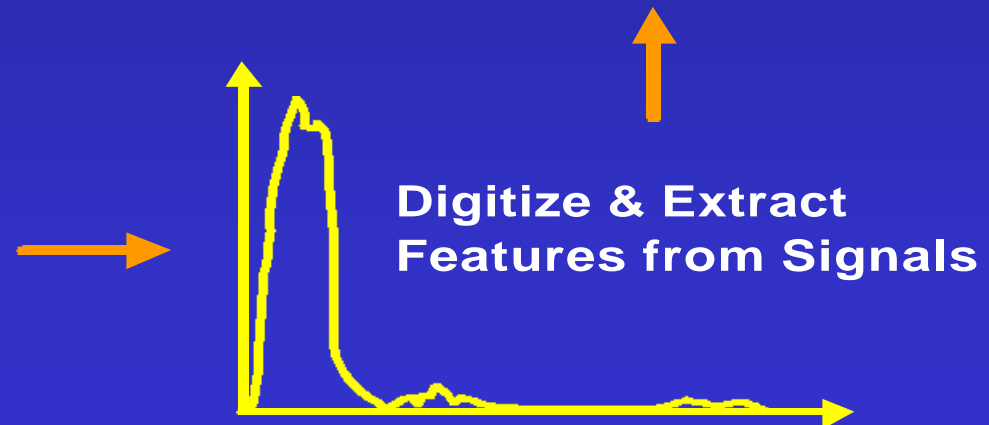
Burrowing Shrimp & Seagrass Remote Sensing Methods Comparison



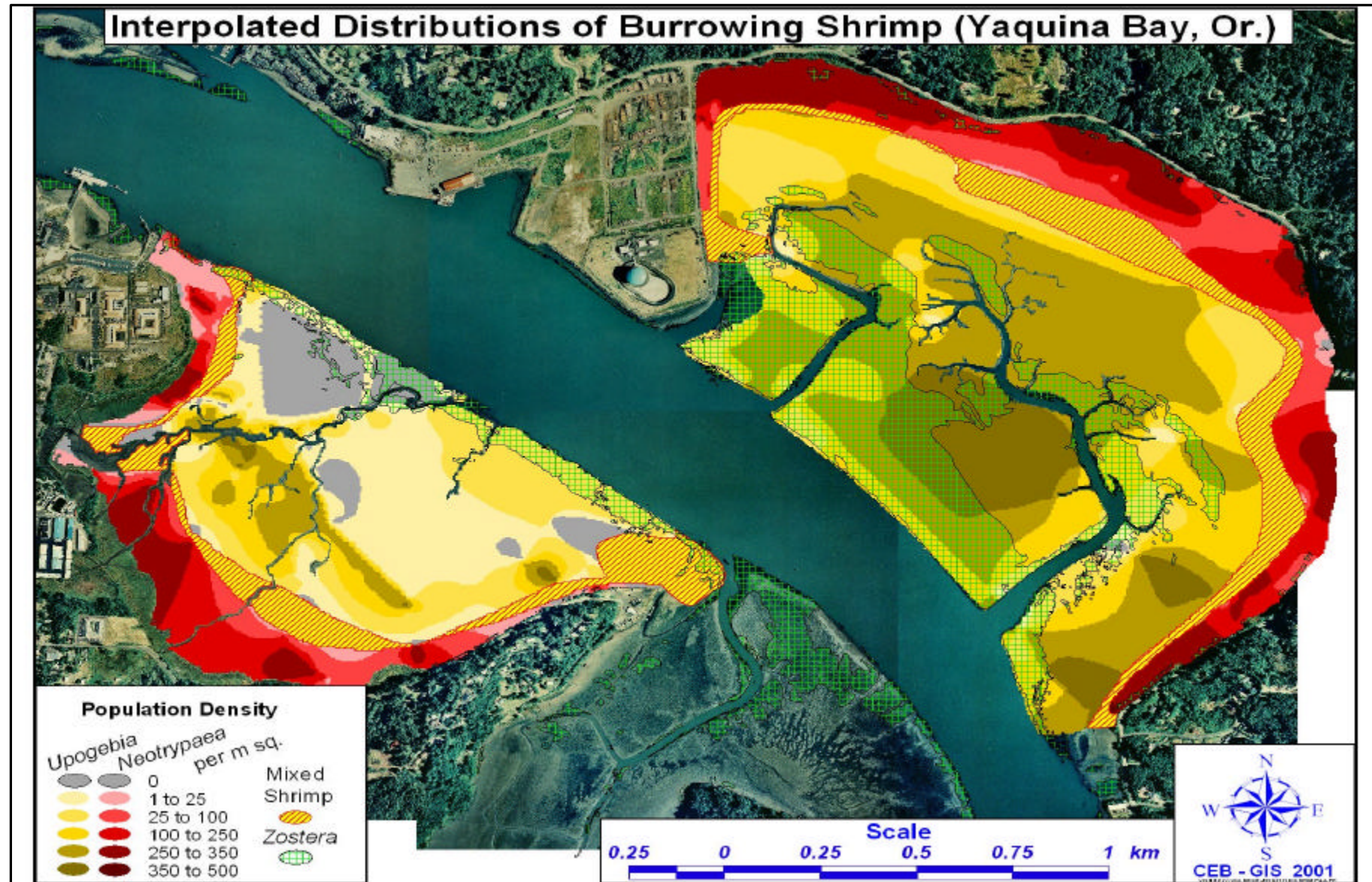
- Sonar (4 kHz to 600 kHz)
- UW & Aerial Video
- Aerial Photography



Principal Components Analysis
to Find Unique Features for Each
Habitat Type



Burrowing Shrimp Population Distributions

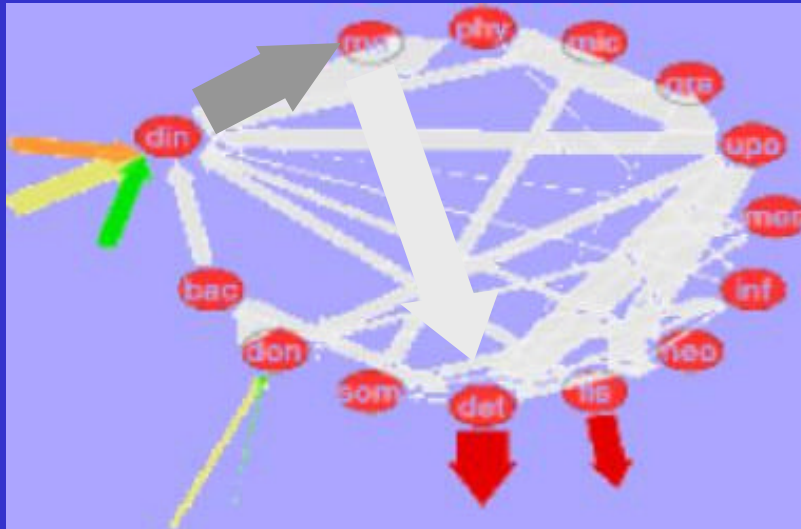


Ecosystem Processes & Services

- Nutrient Dynamics
- Water Quality
- Geochemical Cycles
- Food Webs
- Benthic Community
Structure

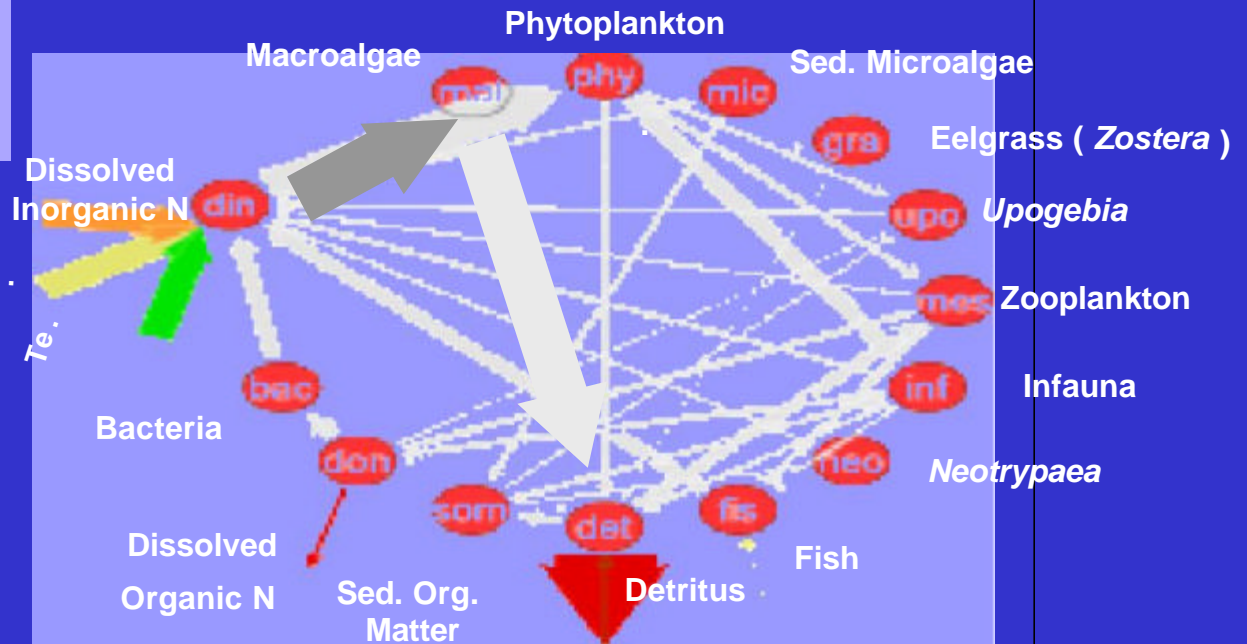
Role in Food Webs

100% Shrimp Biomass



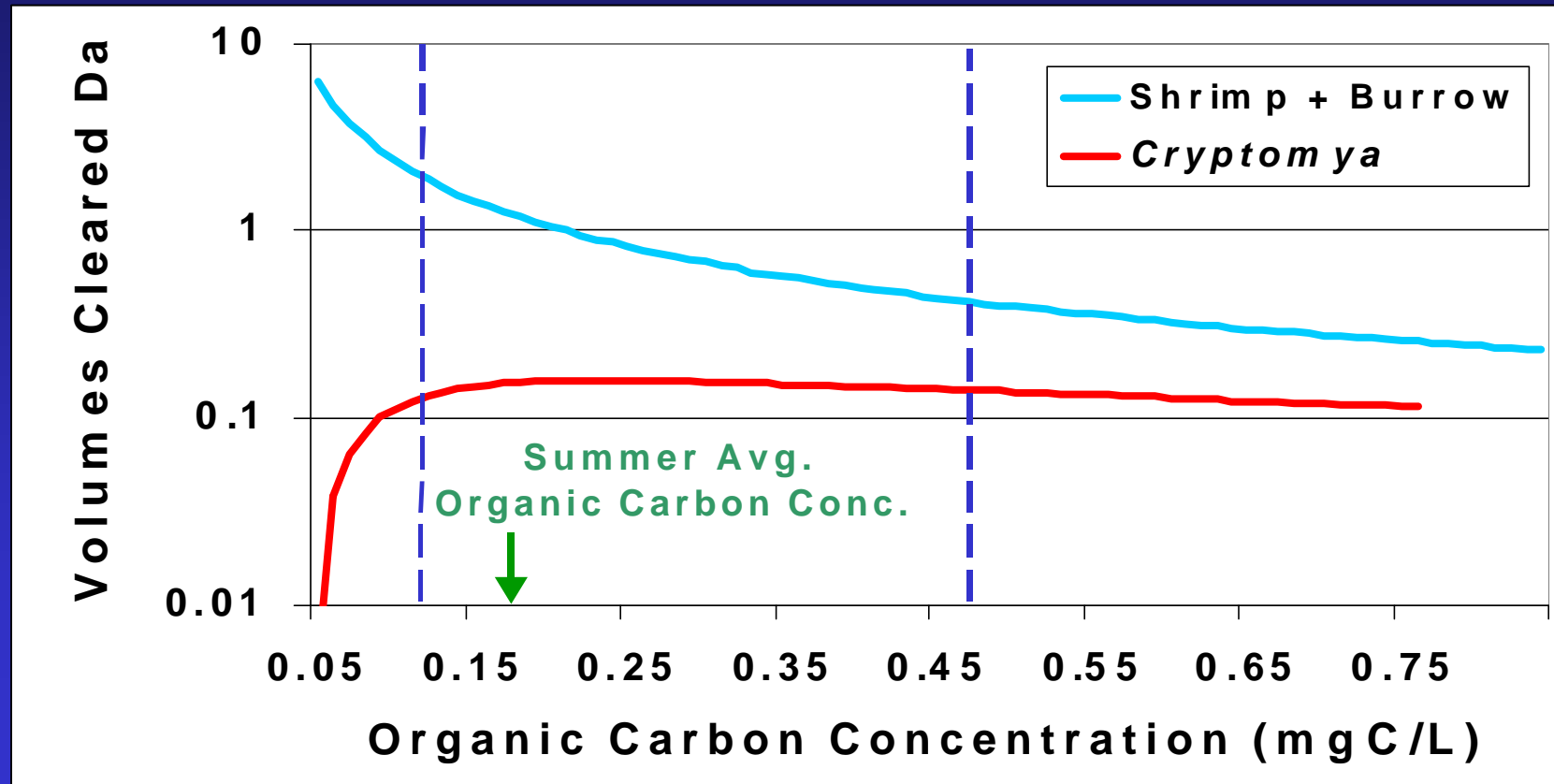
Effect of Reducing Abundance of Burrowing Shrimp on Nitrogen Fluxes

5% Shrimp Biomass



Role in Water Quality (Suspended Matter Load)

Daily Filtration of Water Over Yaquina Bay Tide Flats by *Upogebia* Burrow Complex



Role in Nutrient Dynamics and Geochemical Cycles

Reactive OM & Nutrient Cycling

